SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

No. 988---Vol. XXIV.] LONDON, SATURDAY, JULY 29, 1854. [GRATIS.

THE ELECTRIC TELEGRAPH:

IMPORTANT DECISION OF THE SUPREME COURT OF APPEAL IN THE UNITED STATES.

A case of importance as relating to patent law, and the rights of inventors, has lately been decided in America: we allude to that of the Electro-Magnetic Telegraph, in their Supreme Court of Appeal, in which Hugh O'Reilly and others, representing a company, were appellants, and Samuel F. B. Morse and others, another company, were, in the American term, appellees. The Supreme Court is composed of nine judges, but there were only seven present at the hearing of this appeal, there being a vacancy on the bench by the death of one, and another of them having declined to sit, on account of former professional relations to the Morse patents. The appeal was from a decision of the Circuit Court of the United States for the district of Kentucky in an action at law, in which the appellees had been plaintiffs, and had been successful against the present appellants. The Court had heard the case very fully argued before them in 1853, and had postponed their decision until the month of February in the present year, when it was unanimous in favour of the appellees upon eight points, and divided, four to three, upon two others.

The appellants took three grounds of defence to the plaintiffs' claim—First, they denied that Professor Morse was the original inventor of the electro-magnetic telegraph described in his two re-issued patents of 1848. Secondly, they insisted that, if he was the original inventor, the patents under which he claims had not been issued conformably to the Acts of Congress, and did not, therefore, confer on him the right to the exclusive use. And thirdly, supposing these two propositions to be decided against them, they then insisted that O'Reilly's telegraph was substantially different from Morse's, and that the use of it, therefore, was not an infringement of the patent. The principal question in dispute was as to the validity of the patent which Professor Morse had obtained in 1840, and had reissued in 1848; and it was conceded that the decision on this point would go far to dispose of many branches of the case.

Much scientific evidence appears to have been given on the trial, to which the Court referred in its judgment, and the following is an epitome of the results:—Electro-magnetism was a recent discovery, opening to scientific men in different parts of Europe a new and unexplored field for their labours; and minds of a high order had been engaged in developing its power, and the purposes to which it might be applied, for some years before Morse's invention was made known. The first fact relating to electro-magnetism was discovered by Oersted in the winter of 1819-20, which was widely published, and everywhere received with interest; and it was believed by men of science that this new power might be used to communicate intelligence to distant places. Professor Barlow, of the Royal Military Academy at Woolwich, having, however, ascertained that the galvanic current diminished in power as the distance increased, attempts to construct a telegraph were for a time set at rest. The progress of discovery still encouraged hopes that the attempt was practicable, and many eminent and scientific men, both in Europe and America, became deeply engaged in endeavouring to surmount the great obstacle to success. There appear to have been four competitors for the invention. Dr. Steinheil, of Munich, communicated his discovery to the Academy of Science, in Paris, on the 19th of July, 1838, and he stated in his communication that it had been in operation more than a year. Another of the European inventors, Professor Wheatstone, of London, in the month of April, 1837, explained to Professor Henry, of the Smithsonian American Institute, who had been examined as a witness in the case, and to Professor Bache, who was then with him in London, his plan of an electro-magnetic telegraph, and exhibited to them his method of bringing into action a second galvanic circuit, in order to provide a remedy for the diminution of force in a long distance. It appeared, however, by the testimony of Professor Gale, that the patent granted to Wheatstone and Cooke was not sealed until the 21st of January, and that their specification was not filed until the 21st of July, 1840; and there was no evidence that any description of it was published before 1839. The remaining European patent was that of Edward Davy, which was sealed on the 4th of July, 1838, but the specification was not filed until the 4th of January, 1839; and the American Appellant Court now held that these two English patents when brought into competition with that of Morse, must date from the filing of their respective specifications; for, as the law then stood in England, the inventor was allowed six months to file the description of his invention after his patent was sealed; while, in the United States, the filing of the specification was required to be simultaneous with the application for the patent.

The appellants contended that all, or at least some, of the European inventions were made public before the discovery claimed by Morse, and that the process or method by which he conveys intelligence to a distance is substantially the same, with the exception only of its capacity for impressing on paper the marks or signs described in the alphabet he invented. The Court, however, was unanimous that, upon the evidence before them, Morse was the original inventor of the telegraph described in his specification, and that it preceded the three European inventions relied on. It appeared that his mind had been occupied with the subject in 1832, and it was established, by the evidence of Professor Gale and others, that early in the spring of 1837 he had devised his plan for combining two or more electric or galvanic circuits with independent batteries, for the purpose of overcoming the diminution of force in long circuits, although he had not disclosed it till afterwards; and his delay in bringing it out arose from want of means. He, however, filed his caveat on the 6th October, 1837, and on the 7th of April, 1838, applied for his patent, accompanying his application with a specification of his invention, and describing the means and process used to produce the effect. Although it was alleged by O'Reilly that the plan of combining two or more electric or galvanic currents with independent batteries was not contained in that specification, but discovered, and interpolated afterwards, the Court was satisfied upon the evidence, that the plan as it now appears in his specification had been then invented, and was actually intended to be described. But even if Morse's invention were more doubtful, and even if some of the European inventions had preceded his, the Court held that it would not invalidate his patent in the United States. The Act of Congress provided that when a patentee believed himself to be the first inventor, a previous discovery in a foreign country shall not render his patent void, unless such discovery, or some substantial part of it, had been before patented, or described in a printed publication. In this view of the case it was considered unnecessary to compare Morse's telegraph with the European inventions, which, upon the evidence, were not shown to have been patented until after the application for his patent; for even if they were the same, it would not impair his rights; and upon this point the Court was unanimous with the appellees.

The second view of the case arose on objections to the validity of his patent, which principally applied to the additional specifications in the re-issued one of 1848. The Court conceded that variations from the original description did not necessarily imply that it was for a different discovery; that the right to surrender an old patent, and to receive another in its place, was conferred for the purpose of enabling the patentee to give a more perfect specification. Although this might necessarily vary from the former, there was nothing in his, in the absence of proof to the contrary, which might not be regarded as merely explanatory of the nice and delicate manner in which the different elements of power were arranged and combined together, in order to produce the effect described in the specification. Although there appeared no well-grounded objection to the description given of the whole invention and its separate parts, nor to the right to the patent from the first seven items in the specification, the difficulty arose on the eighth, which was as follows:—"I do not propose to limit myself to the specific machinery, or parts of machinery, described in the foregoing specification and claims—the essence of my invention being the use of the motive-power of the electric or galvanic current, which I call electro-magnetism, however developed, for marking and printing intelligible characters, signs, or letters at any distances, being a new application of that power of which I claim to be the first inventor or discoverer."

The majority of the judges took exception to the extent of this claim, for if it were maintained, it mattered not by what process the result was accomplished. Some future inventor, in the onward march of science, might discover a mode of writing or printing at a distance by means of the electric or galvanic current, without availing himself of any part of Morse's process or combinations; his machinery might be less complicated, less expensive in construction or operation, and still, if covered by the general terms of this patent, neither he nor the public could derive benefit from it without the permission of the patentee. Besides, while he excluded all others, he reserved to himself the power to avail of all new discoveries in the properties and powers of electro-magnetism, which scientific men might bring to light. He did not confine his claims to the machinery, or parts of machinery, which he specified, but claimed a monopoly, however developed, for the purpose of printing at a distance; and new discoveries in physical science might enable him to combine it with new elements and new agents, altogether differing from, and superior to, his present process. If he could thus secure the exclusive use, he might vary it with every new discovery and development of science, and exercise an exclusive right to a process which he had not described, and which had not been invented when he obtained his patent. The Court was, therefore, of opinion that the claim was too general, and not warranted by law—a minority, however, dissenting.

A number of decisions in the English and American courts on patent rights were referred to in support of this view, and strong reliance was placed upon the sixth section of the Act of Congress of 1836, which provided that before a party receives a patent he shall deliver a written description of his invention or discovery, "and of the manner and process of making, constructing, using, and compounding the same," in such exact terms as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, compound, or use the same. If this be not done the patent is declared void, and as the Court presumed that no patent could be issued on this eighth specification, the patent was on that ground illegal and void, unless this portion of it was disclaimed within a reasonable time after the patent issued. The law which requires and permits a disclaimer was declared to be not penal but remedial, intended as well for the protection of the patentee as of the public. It appeared that in this case a disclaimer had not been entered at the Patent Office, but the delay was not deemed unreasonable, inasmuch as the claim had been sanctioned by the head of that office; it had been held valid by the Circuit Court, and differences of opinion in relation to it were found to exist amongst the appellent judges. Under these circumstances the patentee was justified in not disclaiming until the highest court to which the case could be carried had pronounced its judgment. The Columbian (O'Reilly's) telegraph did not profess to accomplish a new purpose, or produce a new result; its object and effect were the same, and it substantially employed the same means, both upon the main line and in the local circuits. Its use was, therefore, a clear infringement of Morse's patent, and the Court was unanimous that the substitution of different marks and signs did not furnish a defence to the action. The majority of the judges, however, held that as a disclaimer had not been entered in the Patent Office before the suit had been instituted, the patentee could not, under the Act of Congress, be allowed costs against the wrong doers, although the infringement had been clearly established. We have since learned from the *Scientific American* of the 1st inst., that Professor Morse having, in accordance with the above judgment of the Appellant Court, disclaimed the eighth claim of his patent, has procured a renewal of it, according to that decision. It is said that the extension met with very strong opposition from parties interested in House's and Bain's patents.

We have thus put the public in possession of this very interesting and important case, which presents some novelty, and shows that the appellant judges in the United States are just as likely to differ amongst themselves as the law Members of the House of Lords are with us. Many of our readers will, perhaps, fancy, when they consider the tendencies of our transatlantic brethren, that the claims of English and European discoverers were not altogether very jealously regarded, nor very religiously protected. Into this subject we cannot at present enter, but it is satisfactory to know that this decision, in which the conflict of opinion on the bench was remarkable, cannot affect, much less conclude, the claims or rights of companies or patentees in Great Britain.

Since the above observations were written, a very interesting article on the electric telegraph, its history, progress, and prospects, has appeared in the number of the *Quarterly Review* lately published. We fancy that we recognise in it the style of the author of *Stokers and Pokers*, and are disposed to attribute it to Sir Francis Head. Although replete with valuable information, and elaborate in its illustrations, the writer does not appear to have been acquainted with the case which we have now been the first to introduce to the notice of English readers. While he admits the rival claims to simultaneous discovery, he decidedly and justly gives the palm to our countryman, Wheatstone, remarking that, until he first directed his attention to electricity as a means of communicating thoughts to a distance, the telegraph was useless—little better than a philosophic toy. He observes that, "to those who now disparage the professor's labours, we think it sufficient to reply by the admirable saying of the French *savant*, M. Biot:—'Nothing is so easy as the discovery of yesterday: nothing so difficult as the discovery of to-day.'" The imperfection in the electric system, that persons cannot communicate without the intervention of a third party, to whom their secrets must be revealed, is, of course, matter of comment. The writer, however, states that he has reason to believe that Professor Wheatstone has invented a cypher, by which messages will be, to all intents and purposes, sealed to any person except the recipient.

The extraordinary cheapness with which messages are transmitted in America are contrasted with the prices charged in England: "for instance, a message of ten words can be sent from New York to New Orleans, a distance of 2000 miles, for 60 cents, or 2s. 6d., not half the sum it would cost to send the same message from London to Bristol, just 112 miles." It is remarkable, however, that the prospects of the Electric Telegraph Company in England improved with the reduction of their charges; and the following evidence of its progress as a commercial speculation, selected from the returns of the company, showing that it last year paid 7 per cent. to its shareholders, cannot fail to be interesting:—

	Miles in operation.	Miles of wires.	Number of messages.	Receipts.	Dividends paid Per annum.
Half-year ending June, 1850	1684	6,730	29,245	£20,436 10 0	4 per cent.
December, 1851*	2122	10,650	53,957	24,336 8 10	6 ,,
December, 1852	3709	19,560	127,987	40,087 18 2	6½ ,,
December, 1853	4409	24,340	212,440	56,919 0 1	7 ,,

It appears by the report of the Electric Telegraph Company, read at their half-yearly meeting, on Thursday, that since the last meeting wires had been constructed on 13 different railways, and that there are now in progress 3869 miles of new wire. Even with the reduction in the tariff of charges, the receipts in the past half-year have reached 61,215*l.* 11s. 9d., a very considerable increase upon those of that preceding; and although much additional expense had been incurred, a dividend of 7 per cent. per annum was again declared.

EDUCATIONAL MEASURES OF THE GOVERNMENT:

INSTRUCTION FOR MINERS.

In the Mining Journal of the 10th June, we directed the attention of our readers to a very important report from Sir Charles E. Trevelyan and Sir Stafford H. Northcote, submitting to the consideration of Government, the present state of the institutions formed for the promotion of practical science as connected with the department of art. We are now enabled to lay before the public the first report addressed to the Board of Trade, by Henry Cole and Lyon Playfair, joint secretaries of the department, as it has been now enlarged to embrace both practical science and practical art. The grounds which induced her Majesty's Government to constitute and extend that department, are thus very emphatically announced in the speech from the Throne at the commencement of the last session of Parliament:—"The advancement of the fine arts and of practical science will be readily recognised by you as worthy the attention of a great and enlightened nation. I have directed that a great and comprehensive scheme shall be laid before you, having in view the promotion of those objects, towards which I invite your aid and co-operation." The Lords Commissioners of the Privy Council for Trade, in order to carry out her Majesty's views, accordingly communicated with the Lords Commissioners of the Treasury by an official letter of the 16th of March, 1853, in which they stated that the object in view was to extend a system of encouragement to local institutions for practical science, similar to that already commenced in the department of practical art, and that the systems should be combined on an enlarged scale. The communication further stated "That arrangements should be made for furnishing, through the instrumentality of one department, in connection with the Executive Government, having the support and being under the control of Parliament, the means for mutual co-operation and correspondence to every district of the kingdom, where the local intelligence and energy of the inhabitants should create schools of industrial science and art."

The Board of Trade further declared that the time had arrived, when the consideration of the important question of supplying scientific and artistic instruction to the industrial classes of this country in a more systematic manner than had hitherto been possible, could no longer be postponed; that the subject was assuming a more prominent position from day to day; and that a recent and forcible expression of the public wants in reference to it had appeared in the surplus report of the Royal Commissioners for the Great Exhibition of 1851. They, therefore, approached the subject with a due appreciation of its importance, and pointed out that more than twenty of the principal cities and towns in the kingdom had already associated with the department of practical art under the superintendence of that board. They further informed the Treasury, that from communications which they understood had been addressed by deputations, and otherwise to the Government School of Mines, by places of great importance—such as Manchester, Birmingham, and Newcastle—they had every reason to believe that a cordial disposition would be shown to co-operate with the Government in promoting industrial science. In the proposed United Department of Science and Art, they announced the motive-power would be local and voluntary—the system in the main self-supporting; while the advantages would be distributed over every part of the United Kingdom, and the assistance received from Parliament applied for the general good of all. To effectuate this object, it was proposed that a metropolitan establishment should be formed, where the most perfect illustrations and models should be accessible to students from the provincial schools, to pupils resident in the metropolis and its neighbourhood, to training masters and to the public at large; that all improvements suggested by experience might be adopted, and made generally known, and the most useful information at all times communicated to the provincial bodies in connection with it. In order to accomplish this end, it was considered essential that the institution should be supported to a considerable extent by fees from pupils; but that the principal teachers in the metropolitan school, upon whose efficiency the whole working of the national system must in a great degree depend, should continue to receive from the State some moderate payment, and be directly responsible to the Executive Government. It was, on the other hand, considered that, if the metropolitan institution were to be wholly sustained by a parliamentary grant, it might be regarded as an attempt on the part of the State to impose its own views of science and art, rather than as a healthy and progressive exhibition of the state of advancing knowledge.

These views, calmly and clearly put forward in still further detail, were immediately responded to by a Treasury minute, in which their Lordships stated that they concurred generally in the plans proposed as the most effectual means of giving effect to the recommendation of her Majesty, at the opening of the session, with a view to the advancement of "practical science." While they coincided with the Lords of the Privy Council for Trade as to the mode in which the efforts of the Government should be directed, with a view to the encouragement of local institutions for practical science, they agreed that the object would be surest attained by

* In this half-year the paid-up capital of the company was increased, and the tariff diminished about 50 per cent. from the original rate of charge.

the creation in the metropolis of a school of the highest class, capable of affording the best instruction, and the most perfect training, which could alone be hoped for from an institution which had the command of the most eminent and distinguished talent, and the advantages of which would be experienced by minor institutions throughout the country. The Treasury further entirely concurred, that it was desirable to leave the management of such local institutions as much as possible to the authorities on the spot, confining their direct support mainly to affording facilities and aid in obtaining suitable and accomplished teachers, and the necessary apparatus and instruments of the most improved description, so essential to their success, and which would give to the central establishment the character rather of a national than of a mere metropolitan institution. They were ready to admit that parliamentary grants could not be sanctioned for more useful objects than those in contemplation, immediately connected as they were with the success of our various industries, and calculated as they are to aid in the competition to which these industries would be more and more exposed in the great neutral markets of the world, and in the development of the numerous natural resources of the country, and especially those of mining and agriculture. The Treasury, also, approved of the adoption of every means to render these institutions as far as possible dependent on themselves, not only because they felt it incumbent upon them to confine the public expenditure to the lowest limit, but, also, because they entertained a belief that the utility of such institutions is great in proportion as they are self-supporting. They further sanctioned the proposed arrangement, which would unite in one department, under the Board of Trade, with the departments of practical art and science, the kindred and analogous institutions of the Government School of Mines and Science, the Museum of Practical Geology, the Museum of Irish Industry, and the Royal Dublin Society, all of which are in part supported by Parliamentary grants; and the Lords of the Treasury directed that the estimates for all these institutions should be brought together under the general head of "Board of Trade Department of Science and Art."

These communications, explanatory of the views of the Government, are fairly introductory to the report which we have selected as the subject of our observations. The joint secretaries assure the public—and it is desirable that this should be fully understood in every country district—that the metropolitan establishment is not intended as an institution for the benefit only of the residents in or near the capital, but as a centre of union, whence students from all parts of the United Kingdom might derive knowledge, and carry the same back to their own localities. As it is desirable that the action of the joint departments should be conducted as much as possible as a unity, and not in separate divisions for science and art, its intended operations, as they naturally develope themselves, may be classed under four broad sections. First, the aid to be afforded to institutions and schools entirely independent of the department bearingly particularly on primary education.—Secondly, aid to schools in connection with the department which may be viewed as providing secondary education.—Thirdly, the proceedings of central schools influencing more particularly advanced or technical instruction.—And fourthly, general administration, and miscellaneous matters referred to the department.

The simplest mode in which aid is given under the first head is by the supply of examples, models, diagrams, apparatus, &c., suitable for teaching; and these are furnished to institutions and schools of a public character, established chiefly for the primary education of the poorer classes, upon the condition that at least half the prime cost is paid by the requisitionists. It is justly observed that, in both science and art, the want of good examples and apparatus at a moderate price is greatly felt, and they have for the most part to be created. This want will be thus, to a great measure, supplied by the encouragement thus proposed to be afforded by the parent establishment. In regard of science, the existing apparatus and diagrams, although often well suited for collegiate education, or for illustrations in large institutions, have been found not well adapted either for primary or secondary school instruction. It was found that philosophical apparatus, illustrative of the several sciences, existed only in unconnected and expensive forms, and were rarely so arranged as to be available to any but the experienced professor. It has been deemed advisable, therefore, to select a well-approved work on each particular science, and to arrange a series of apparatus and diagrams, to be used in the special illustrations of it. In following this plan, it was considered necessary that the department should not be an arbitrary judge of the works which it recommended for use; that it should not interfere with the usual channels of trade in creating its illustrative machinery: and these conditions have been attained by the generous co-operation of eminent scientific men. To their judgment has been confided the selection of the text-books to be illustrated; and when these have been fixed upon, their publishers have generally with readiness entered into the task of further illustrating them by the preparation of diagrams, or by making special arrangements for the sale of separate series of apparatus. Their immediate preparation is entrusted to men of the highest eminence, as will be seen by the following examples:—

Mechanical models and diagrams	Prof. Willis, F.R.S.
Electrical models and diagrams	Prof. Wheatstone, and Sir S. Harris, F.R.S.
Geological diagrams	Mr. Jukes, F.R.S.
Physiological diagrams	Mr. Marshall, and Prof. Sharpey, F.R.S.
Botanical diagrams	Mr. Henfrey, F.R.S., and Mr. Archer.
Zoological diagrams	Mr. Patterson, F.R.S.
Chemical diagrams	Dr. Hofmann, F.R.S., & Mr. Galloway, F.R.S.
Chrystallographic models & diagrams	The Rev. Mr. Mitchell.

The department having officially communicated to the Committee of Council on Education that it acted through publishers only, and without interfering with trade, and that it did not itself manufacture either diagrams or apparatus, further declared that it would be a great inducement to the publishers to undertake the issue of such illustrations if the Board of Education acted with them. To this a reply has been received, that the Committee of Council on Education will gladly place upon their lists such diagrams and sets of apparatus as might be issued with the approbation of the department. We have been thus minute in explaining the views and intentions of the Government on the all-important subject of scientific education;—to no classes in the community of such extreme value as to those engaged in mining and metallurgic operations. While the State is making such exertions, and affording such opportunities for improvement, it is incumbent on the local districts, who are so deeply interested in the advancement of the project, to tender their anxious and ardent co-operation. As we feel conscious of the vast social and commercial advantages which must result from the proposed educational system, we intend to devote some of our future space to the further elucidation and promotion of this great national object.

Carvath United Mines.—In our Journal of the 15th instant, we reported the setting to work an excellent steam-engine upon this mine, constructed by that talented engineer, Mr. W. West; and having the means of knowing through the medium of our own correspondents, upon whose reports we can safely rely, it is with pleasant feelings that, on this occasion, we have their testimony to the truth of what we gave insertion to. In addition to this, one of our correspondents, who has had long experience in the district, and was himself on two or three occasions an applicant for the mining sett in question, knowing that in the last working the water was drained by the inadequate means of a water-wheel and wooden pumps, and having a competent steam-engine and boiler, with adequate pitwork at his own immediate disposal, a company with ample capital ready to embark in any mine of promising character, he at once named the Carvath Mines as the spot he should be disposed to adventure in; and all was ready but the deeds of the sett, which unfortunately could not be as easily procured as the sanguine wishes of the parties desired. Consequently, the engine and capital were placed elsewhere; and the Carvath remained in *statu quo* till the present more successful party obtained possession of it. In conclusion, we can assure our readers that the individual alluded to is neither interested directly or indirectly in the present workings; nor was he present when the engine went to work, or at the happy meeting of "One and All," that congregated to celebrate the event—being at the time located far from St. Austell. Having a strong opinion that their exertions would be crowned with success, and being a well-wisher to the county, and particularly to all parties embarking their spare capital in its mines, he was solely prompted to record his sentiments at this eventful moment, as they are in unison with what he felt years ago, when he expected to have been at the head of the concern. The locality is of proved worth. Around it are mines that have yielded great riches; and capital, under judicious management, is almost certain of success. It is a curious, though sad matter of fact, that capitalists are so ready to expend scores and hundreds of thousands in any foreign mining bubble—as witness the numerous gold ones during the last two or three years—that the further they are distant, the more welcome. The difficulties are an inducement rather than otherwise. Climate and soil are not deemed worth a consideration. Large salaries are paid to inadequate men, who are sent out to misdirect and mismanage, most of them totally ignorant of mining pursuits; and the result is, in 19 cases out of 20, the whole is a wreck. One-tenth of the capital embarked in either of these foreign delusions would suffice to bring the Carvath into good working order. One day from London or Liverpool, the shareholder could be upon the spot. One hour thereon would enlighten him as to its management and value; and even supposing a novice in such matters, there are bankers, merchants, solicitors, and mine agents in abundance to confer with, who, being residents of long standing and experience, alike honourable and trustworthy, are ever ready to guard the stranger from being plundered by the attempts of those who go about "seeking whom they may devour." All our home mines possess these advantages—those in foreign climes alone are without them; therefore, in both cases the maxim should be—"Look before you leap."

SUGGESTIONS FOR THE USE OF THE BLOWPIPE BY WORKING MINERS.

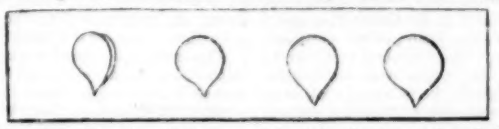
By John Paidraux, Member of the Royal Cornwall Institution, Geological and Polytechnic Societies.

The simple instruments and materials, described hereafter, will be easily procured, and generally sufficient. The miner who desires further instruction may have recourse to a little book, containing, in small compass, and at small cost, much valuable information—"Scheerer on the Blowpipe;" or the more scientific work of Plattner, translated by Muspratt, which, however, requires more chemical knowledge.

The most convenient cheap blowpipe is Griffin's, at 1s., with a little brass nozzle; but the common silversmith's blowpipe, sold at ironmongers for about 6d. will answer the purpose in most cases, and a common miners' candle will serve for the flame; though a lamp with a half-inch flat wick, or two small round wicks (quarter of inch) nearly side by side works steadier, and of course is not subject to melt down like the candle; and a flattened gas flame, where at hand, is better than either.

To support the subject of assay, or "the assay," as it has been happily denominated by Children, two different materials are requisite, according as we wish to calcine or reduce it. For the latter purpose, nothing is so good as charcoal; but that from oak is less eligible, both from its inferior combustibility, and from its containing iron, than that from alder, willow, or other light woods.

For calcination, a convenient support is a cupel of white clay, selecting such as will not fuse, nor become coloured, by glazing with borax. They are easily made, as follows:—In a slip of sheet copper, or brass, 3 to 4 in. long, about ⅔ wide, and 1-30th or 1-32d thick, have 4 or 5 round holes,



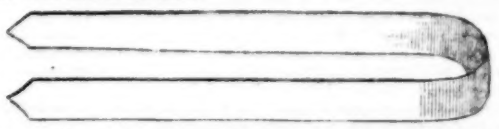
from ¼ to ⅔ in. diameter, their inner edges being kept smooth and clean. Place this on a slip of paper, and fill the holes with clay, prepared as below, removing the excess with a clean knife (of ivory or bone, if at hand). Turn out the cupels, which may be as thick as a wafer, and hollow them 1-16th to ⅛th in. deep, by pressing each, in the hollow of the hand, with the round end of a glass tube, the round brass head of a nail, or a very small marble stuck on a cork. This instrument must be very clean, lest it should communicate a false colour to the cupel when borax comes to be melted on it; and may be rubbed across your forehead each time before pressing the clay, to prevent adhering by the little greasiness it acquires from the skin. A little handle, for holding in the forceps, is easily given them, by notches in the edges of the holes, as in the figure.

Good white pipe, such as the Poole clay, answers very well, but is improved by an equal mixture of China clay. It should be mixed soft enough to bear the hollowing down without cracking, but not so as to stick to the hand, or the edges of the hole. They must be dried gently, say an hour or two, before the fire, and may then be baked at a bright red heat, in a small crucible, or tobacco-pipe.

They should be baked in a clear fire, to keep out coal-dust and smoke as much as possible, as either of these adhering to the clay plates would colour the borax in melting. A small fragment of the bowl of a new tobacco-pipe will serve instead, in the absence of a more convenient material.

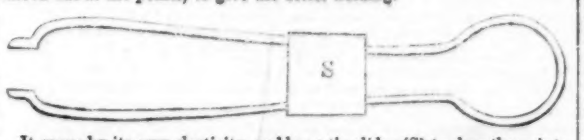
These cupels are useful, not only for calcination, but also for ascertaining the colours of oxides with borax, in the oxidating flame, as will be presently explained.

A simple pair of forceps, to move and take up the hot assay, may be made of a slip of stiff tin-plate, 8 in. long, ½ in. wide in the middle, and 1-16th of an inch at the ends.



The tin being rubbed off the points on a rough whetstone, the slip is to be bent until they approach each other within half an inch, and the two sides are parallel: thus there will be spring enough in the forceps to open and let go the assay, when not compressed upon it by the finger and thumb.

Another kind of forceps, convenient for holding the clay cupels and fragments of minerals, is formed of iron-wire, turned as below, and hammered flat at the points, to give the better holding.



It opens by its own elasticity, and has a tin slider (S) to close the points and keep hold of the cupel, or other subject of operation. Of course, the points must not touch the melting borax, as they would tinge it with iron. Either of these will be made by a tinman for a penny.

A magnetic needle, very desirable to ascertain the presence of iron, is

easily made, of the requisite delicacy, where a magnet is accessible. A bit of thin steel wire, or a long fine stocking needle, having a quarter of an inch cut off at the point, is to be heated in the middle, that it may be slightly bent there, thus: While hot, a bit of sealing-wax is to be attached to the centre, and the point which was cut off, bring heated at the thick end, is to be fixed in the sealing-wax, so that the sharp end may serve as a pivot, descending about ⅛ in. below the centre, taking care that the ends of the needle fall enough below the pivot to keep it from overturning. It must now be magnetised, by sliding one end of a magnet, half-a-dozen or more times, from the centre to one end of the needle; and the other end, a similar number of times, from the centre of the needle to its other end. A small brass thimble (not capped with iron) will do for the support; the point of the pivot being placed in one of the indentations, near the centre of the top, when, if well balanced, it will turn, until it settles north and south. If one side preponderate, it must be nipped until the balance be restored.

A black gun-flint is also occasionally used to rub the metallic globules (first attached, whilst warm, to a bit of sealing-wax), and ascertaining the colour of the streak they give,—thus minute particles of gold, copper, silver, &c., are readily discriminated. A little refined borax and carbonate of soda, both in powder, will complete the requisites.

Having collected these materials, the next object for the operator is to acquire the faculty of keeping up an unintermitted blast through the pipe, whilst breathing freely through the nose. This is easier to learn from example than from written instructions, yet, with attention, I believe the following will be found generally sufficient.

Any one free from nasal obstruction can breathe freely through the nose with the mouth closed. Having done this for a dozen successive respirations, let him inflate the cheeks, and keep them so by pressing the tongue against the roof of the mouth. In this manner he will immediately, or very soon, be able to breathe through the nose just as freely with the cheeks inflated as in the ordinary state. When he can do this without effort, the large end of the blowpipe is to be taken between the lips, and the mouth inflated as before. The pressure of the cheeks will thus force a stream of air through the pipe, and the mouth will quickly become nearly emptied. It must then be inflated a second time, by forcing in air from the lungs, over the tongue, and again suffered to empty itself through the pipe, by the pressure of the cheeks, continuing the respiration all the while, at ease, through the nose. When this has been repeated several times, so as to have attained the power of breathing calmly, whilst the current through the blowpipe is produced entirely by the action of the cheeks, the next step is made by forcing in air over the tongue, before the mouth has completely thrown out the air it contains, and whilst the current is still continuing through the pipe. Thus he may keep up a continuous blast for a quarter of an hour, or more, without impeding his respiration, and with no other fatigue than of the lips where they press the pipe. The next lesson is the regulation of the blast. For this purpose a candle with a longish snuff is to be lighted, and placed in a sloping position, the upper part of the wick being bent down nearly horizontal toward the same side as the candle leans. It is to be so placed that the operator, with both elbows leaning steadily on the table, can apply the point of the blowpipe just behind the flame, so as to blow it along the bent wick. The blowpipe should not quite touch the flame, and should direct it a little clear of the wick, that the jet may be round and smooth. When properly produced, it will consist of a clear blue-pointed flame inside, with a yellow or reddish transparent outer one. If the outer flame is bright, dense, and sooty, like the ordinary flame of a candle, it indicates that the blast must be stronger, or that the aperture of the blowpipe must be enlarged, or brought closer to the flame, unless a smaller candle be employed. Now, supposing the operator to have produced a clear smooth flame, which does not smoke the edge of a sixpence, placed at the blue point within it, let him rest the bend of the blowpipe, as well as his elbow, so that the instrument may remain perfectly steady. He must now practice, until, by regulating the pressure of his cheeks, and the filling of his mouth from the lungs, he can keep the jet, without puffs and jerks, as constant and firm as the pipe itself.

Let him next make a little cavity (to or three times the size of a split-pea) in a piece of charcoal, and putting therein a fragment of malachite (green copper) not much larger than a mustard-seed, bring it up to the flame, so that the inner blue point shall act directly upon it; in a few seconds he will find it reduced to a bead of malleable metallic copper. Continuing the blast, let him remove it into the outer flame, almost to the extreme point, he will soon find it covered with a crust, and, if put on one of the pipe-clay cupels, it will be calcined throughout by the action of the external flame, and crumble under the blow of a hammer. Hence, he will learn the third lesson, that the flame answers the double purpose of the calcining and reducing furnaces—the outer flame being the calciner, the inner one the reducer. And this is the most important point of blowpipe knowledge. The reducing action is increased by removing the blowpipe a little farther from the wick, so as to give the external flame more density, and a slight tendency to smoke the assay. The calcining action, on the contrary, is promoted by putting the point of the pipe quite into the flame of the candle, so as to make the outer flame of the jet very transparent, and only just visible. A little harder blowing is more suitable for calcination than for reduction.

Most of the ores having a metallic aspect (as yellow and grey copper, lead ore, mundic, white cobalt, &c.) contain sulphur, and require much calcination before being reduced, otherwise the globule may be deficient in quality or quantity, or both. Some of them fly on being heated, in which case the flame must be brought upon them gradually, letting it first pass over them, and raising them very slowly into it. But there are some which decrepitate and fly about when heated even in this cautious manner. These are conveniently heated over the flame, in the closed end of a glass tube, till the decrepitation is finished, a bit of thin tube, 3 or 4 in. diameter and a ¼ in. bore, does very well, or, where not to be had, a little iron thimble answers instead.

As soon as the decrepitation is finished, the jet should be discontinued, and the assay thrown out on a plate. A particle will then most likely be found large enough to work upon; but if not, the operation may be repeated on a larger piece, or a good knob of it heated red, in the bowl of a tobacco-pipe, covered, in a common fire. After once heating red, the assay is no more subject to decrepitation.

In calcining ores, care should be taken not to melt them, as that retards the process; the heat should be applied at first gently, keeping the assay beyond the reach of the flame, and approaching as the sulphur is driven off, and the assay becomes less fusible. This process should be performed on the pipe-clay cupels, applying the flame beneath, first worked together with moisture, if in powder.

[*To be continued in next week's Mining Journal.*]

COLLIERY OPERATIONS—"TUBBING."

TO THE EDITOR OF THE MINING JOURNAL.

Sir,—If Mr. Dickinson would respond to the request of your correspondent, and give us some practical details of the contrivances adopted in Lancashire for economising the cost of production of minerals, he would confer a great boon on your readers. It has often occurred to me that practical men do not avail themselves, so fully as they ought, of the valuable opportunies of improving themselves and others which they have by contributing to your Journal (in their own way) details of the various applications in mining which they are engaged in. The publicity which you are kind enough to give cannot fail to be useful; to themselves, in the first place, by improving their minds, and to others in proportion to the value of their attempts. Trusting, therefore, that you will deal gently with the attempt, I will, in what follows, give you a practical man's account of putting in "tubbing" for stopping back feeders of water issuing from the strata in course of sinking for coal.

There are various methods of "tubbing;" I will first describe "plank tubbing," or "open-topped-tubbing." The first and principal thing in all tubbing, is to find a good and close stone for a bottom for the wedging crib, or foundation of the tubbing, this is done by sinking with caution, so as to take advantage of the first good close stone you come to; hard blaes or shale, or hard stone, if it be close in the grain, will do. Great care must be observed in blasting near the wall side of the pit, in case seams or cracks be made by the powder, which has a tendency to damage the sides or bottom; no shots at this period ought to be fired, except in the centre for a sump, which ought to be from 3 to 6 ft. below the bottom for wedging crib, for convenience of water or any thing else required. The position of the wedging crib being fixed upon, I will now detail the operation of forming the site for it and putting it in.

For a pit 9 ft. in diameter, and a pressure of water 60 ft. in height, the wedging crib should be 9 in. broad, by 4½ in. thick, and made in segments of good oak. The recess for it must be cut 9½ inches in from the flush of the pit regularly all round, and trained from a centre line; when it is cut out and made water level, it it ready for smoothing with adze-shaped picks, made for the purpose, and all the pick-holes smoothed out, to 10 in. from the side of the pit, or to 10 ft. 8 in. diameter. If a faulty place is found in the back of the "crib hole" it must be carefully cut out, and adzed with caution, and no wedging attempted until it is quite sound. After this is finished the crib is laid on its place, and trained to the diameter, the space between the back of the crib and the wall side (1 inch) is filled up with wood "gluts," made of dry memel wood, about 5 inches long and 1 inch thick, without taper. It is of great importance getting the crib well packed; the "gluts" must be driven regularly round and to the bottom, so that the bottom as well as the top is filled up, and the closer it is put in the less wedging is necessary. When no more "gluts" can be driven, wooden wedges are driven in, these wedges are also made of dry memel, about ½ in. thick, and tapered regularly off each side to a point. The first two or three courses of wedging you will be very apt to raise the crib up; this may be prevented by putting up stays from the crib to the rock above. When the wedges become very difficult to drive, a space is made for them with an iron wedging chisel, which must be 8 in. long by 2 in. broad in the flat or chisel part, and after these have been used as long as possible, chisels about 1 inch broad must be used until the chisel can hardly be driven in; the wedge-heads, while wedging, must all be cut off level with the top of the crib by a sharp-cutting chisel. When the wedging is finished, you cover the crib with sheathing deal ½ in. thick. I have always found it advisable to lay on a second wedging crib, in case of any deficiency in the first; for after it is laid there is no other remedy. The second crib, of the same dimensions, is laid on the top of the first, and treated exactly in the same way, and covered, when finished, with sheathing.

The next operation is placing the "spiking cribs"—that is, those to which the planks are nailed to; the spiking cribs are made of hard wood, 5 in. broad and 6 inches deep, and are made in segments of convenient lengths. The first spiking crib must be laid on the top of the wedging crib, the thickness of the plank back from the face, so that the plank will be flush with the face of the wedging crib; this is trained to its position by the centre line, and tightened up to it by pieces of wood jammed between the back of it and the wall (no nails or bolts are used), and others put in above it at intervals of 2 feet for the first length of planking: if the first two cribs are put up by the centre line, the others may be set by a straight edge, but they must all be right, or the planks will not "cleed." The planks should be of dry memel, 3 in. thick, 6 in. broad, and any convenient length, from 9 to 12 ft., but they must all be cut to one length, and flush with the top of the top spiking crib (not to half the crib for joining another length; for the next spiking crib for the succeeding length must be laid on the top of the last with sheathing between, covering the ends of the first lengths, to wedge the plank ends of each length of planking). The planks must all be squared at top and bottom, and set on the edges to the 9 ft. circle. The first plank is set plumb with a plummet, and fastened to

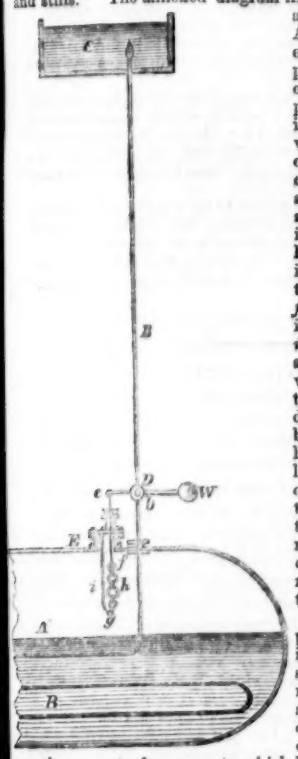
the spiking cribs with iron spikes 6 in. long, ½ in. square, and barbed at the sides; each spikehead must be leathered with a leather washer, or be lapped with spun yarn, to prevent leakage, two spikes to be driven in at each spiking crib. After the first plank is fastened, three planks may be put up together; these are set up close in the joints before being nailed by means of a set-rod, set-bolts, and wedges. The set-rod is one of the 2-inch planks, about 6 inches broad and about the same length or longer than the other planks, with a flat bar of iron, 2 inches broad and ¼ inch thick, nailed to one edge, the other end is bevelled to the circle of the tub. The set-bolts are about 4 inches long and ⅞ inch square, with a gib on the end, for drawing them out and for guiding the wedges. The wedges are 7 inches long by 2 inches broad, and ¾ inch broad at the top, and tapered off one side to the point.

The set-rod is set up close to the three planks, the smooth edge next the planks, and holes bored in the spiking cribs for the set-bolts, close to the iron face of the set-rod, and the wedges driven in between. When the planks are thus tightened they are made fast with spikes, as before described, the wedges are then slackened, the set-bolts, &c., removed, and other three planks put on; when they are all put on to the last one, it must be filled as tight as possible and driven in. I may here remark, that the planks must be all carefully jointed, otherwise they cannot be set tight up. When all this is finished, the ends of the planks must be all cut carefully level with the top of the spiking crib; ½ inch sheathing is then laid over it, and the first spiking crib of the next length laid and finished, the same as before, with the difference that the spiking cribs may be put farther apart as the pressure lessens. When the whole length is completed, a broad crib should be laid on the top, and wedged from the stone above, not with a view to be water-tight, but to prevent the whole arrangement rising when you are wedging the joints at the ends of each length, as it will be understood there will be no necessity for wedging the sides if the joints are properly made. Plank tubbing is sometimes applied to square or oblong pits, but it cannot, in such cases, be so economically applied, and I do not think it worth while describing it.

July 20. A Newcastle Collier.

ANTI-EXPLOSIVE APPARATUS for STEAM-ENGINE BOILERS.

Mr. Henry Dircks, of Moorgate-street, has secured a patent for the invention of "Improvements in safety apparatus, applicable to certain boilers and stills." The annexed diagram illustrates one mode of applying the apparatus to steam-engine boilers:—



A, being the boiler; B, a coil of pipe entering the top of the boiler, and passing out at the bottom of the front end, being well secured to the boiler-plate by suitable collars. This pipe is continued upwards at B', to a cold water cistern, C, at any convenient elevation, the flow of water being checked at D, by a water cock, having a lever handle, *b*, weighted at W; at E is a metal collar on an aperture in the boiler, of about 3 in. diameter, having a strong cover, with a stuffing box, and a rod, *e*, *f*, working therein, from which hangs a chain, *f*, *g*, having a fusible metal ring, *h*; into the cover is screwed a metal rod, *i*, hooked at one end, and fastened by an eye therein to the lower link, *g*, which thus prevents the descent of the weight, W; but which immediately falls when the chain is broken by the melting of the fusible ring or link, opens the water cock, and allows a flow of water through the coil of pipe, B, which escapes thence into the furnace or ash-pit. By this means the coil of pipe, B, acts as a refrigerator on the overheated boiler, without adding to its contents, and thus reduces the internal pressure, should the safety valve prove inoperative.

The patentee observes—"The application of this safety apparatus is independent of the usual guages, safety valves, &c., none of which need be disturbed. It demands no attention, and may be locked up out of the control of workmen. The engine proprietor has only to decide on the amount of pressure to which he will risk his boiler in extreme cases, and that pressure can never be exceeded by malice, caprice, carelessness, or ignorance, without immediately cooling the boiler."

In a paper on the subject of boiler explosions, Mr. Dircks says—"It is well known that certain gases have the property of assuming a solid or liquid form under excessive compression; and that compression may be performed mechanically, or be generated in closed vessels by the chemical action which eliminates the gas. So steam (called by the Germans water gas), by excessive pressure, would assume a liquid form, supposing it existed under many atmospheres in a strong metal chamber, forced therein from a suitable steam pump; and such compression would only be limited by the chamber becoming filled with liquid. That liquid would be liquid steam. And if a strong metal chamber containing cold water were sufficiently heated, its contents would, equally with the other, be liquid steam. This is too obvious to be disputed, for we are not discussing the possibility of making the experiments exactly as stated; but admitting the compression of steam in the one case, and the heating of an equivalent quantity of water in the other, the results must then be equal."

He also remarks that—"If, while the water contained in the boiler is assuming a state equivalent to liquid steam, the safety-valve should suddenly be released (presuming it previously locked or fastened), the outlet thus afforded to an enormous pressure of steam within the boiler will, at that moment, so far from safety, only promote an eruption; indeed the boiler is then little better than a piece of ordnance with the muzzle plugged up, the touch-hole alone being open! The rush and violence consequent on such a sudden flash of fluid into steam, is more than the safety-valve will permit to escape, and, therefore, it tears all before it. The following instantaneous collapse of the surrounding large volume of atmosphere is as violent and energetic outside the boiler, as the steam was within it, and acts by the return of the atmosphere to an equilibrium, to force the boiler from its seating, and carry it upwards, with whatever is in its vicinity."

In reference to the action of the fusible alloy, on the melting of which the salutary action of his apparatus depends, he remarks—"Combinations of tin, lead, and bismuth, in different proportions, melt at known temperatures. Thus in parts of 3, 5, and 8, the alloy melts at 212°; while in parts of 2, 3, and 2, the alloy melts at 270°. Then, as we know the temperature of given pressures, we can accommodate the alloy to melt at very nearly the required pressure, which I call the "danger heat," simply meaning thereby, that the master of the mill, or other works, has determined not to work at pressures beyond that point; thus, 15 lbs. pressure is 251°; 30 lbs. pressure is 270°; and 60 lbs. pressure, 309°.

The apparatus is not limited in use to steam-boilers, neither need it always be worked by fusible alloys. "For stills, coppers, and the like, the refrigeratory apparatus may be put on by a standard, elevated by the rising of a float whenever the contents of the vessel incline to boil over. Portions of the apparatus may also be used as guages, merely to point out excess of heat, without any refrigerator."

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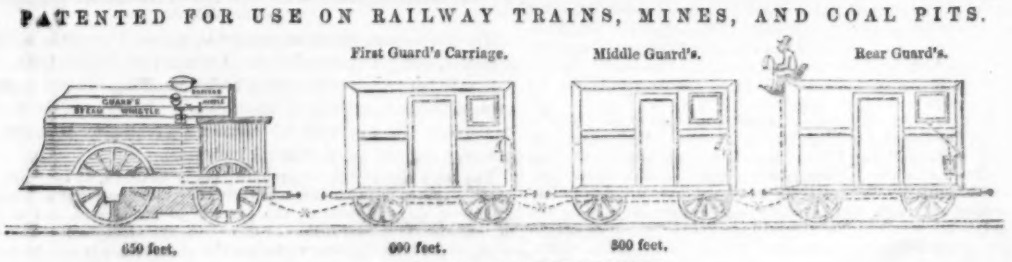
THE AIR-ENGINE TELEGRAPH:

PATENTED FOR USE ON RAILWAY TRAINS, MINES, AND COAL PITS.



RAILWAY TRAIN OF THIRTY CARRIAGES.

Many of the railway accidents which have occurred, would, in all probability, have been prevented, or, at least, rendered less fatal, if the directors had provided all the guards on a train with the means of giving stop or danger signals to the driver and each other, thus insuring the immediate reversal of the engine, and the simultaneous application of every break on the train. The practical difficulties of establishing an efficient means of intercommunication between guards, driver, and passengers, have hitherto been found inseparable. The Clearing House Committee, in February, 1853, rejected air-whistles, speaking-tubes, compressed air, and numberless other contrivances, as useless or unsuitable. Electricity was also offered to the Committee, and declined; the objections to the use of the volatile electric power on railway trains being insuperable, and well known to scientific and practical men. The companies spent 4000*l.* in trying the bell-and-rope experiment, which failed, as expected, and was immediately discontinued; an experiment with electricity would have failed also, and occasioned a loss to the companies of, perhaps, four times that amount.

The Air-Engine Telegraph possesses every requisite, and meets every possible difficulty pointed out in the report of the Committee of the Clearing House. It obviously comprises all, and more than all, the advantages of electricity, with the simplicity, cheapness, and power, of the rope and bell, without the insuperable defects of either. This engine telegraph affords the only known means of certain, instantaneous, and powerful signalising throughout a train in danger; yet the apparatus is far more simple, and less expensive, than any hitherto constructed.

It will be seen from the above sketch, that the patentee is working atmospheric air in distant cylinders on the hydrostatic principle; by combining ærial velocity with something like hydraulic power, he obtains enormous signal power and simultaneous action, in an unlimited number of distant signalia cylinders.

The apparatus for a monster train of 30 or 40 carriages will generally consist of a small metallic cylinder (or elastic vessel), about 10 in. high by 3 in. in diameter, and containing a metallic piston-rod, with or without a lever handle. By this cylinder the inventor raises with ease, if required, ¼ cwt. on a small cylinder placed on the engine, several hundred feet distance. The power he requires to work the steam-whistle or bell is under 1 lb. A similar, but smaller cylinder, 3 in. high by 3 in. in diameter, containing a piston-rod, and sometimes a vulcanised India-rubber bag, is placed on the engine in connection with the steam-whistle or signal bell.

A conductor of ¼ in. common gas-pipe and vulcanised India-rubber connects the guard and driver cylinders; the conductor between the carriages is linked and unlinked instanter, by means of a patent neutral joint of peculiar construction, containing two inner India-rubber pressures. The rear guard, wishing to signal the driver, depresses the piston-rod in his small cylinder; the piston in the driver's signalia cylinder rises, and works the steam-whistle or bell signal instanter at 600 or 1000 ft.; also simultaneously in each guard's carriage, if required. That the railway companies will manufacture the whole of this durable telegraph apparatus for about 6s. per carriage, or 2*l.* 19s. per express train, or one-third the cost of electricity, or other contrivance yet invented.

[A description of the Air-Engine Telegraph, as applied to mines and other purposes, will be given in a subsequent Journal.]

Carlisle and Silloth Railway.—It would be difficult to judge the standard which regulates the decision of committees of the House of Commons. If they reject a bill, they are competent to do so without assigning any other reason than merely the "preamble is not proved;" and the promoters, after being put to a large expense, and consequent anxiety, have no appeal from the judgment thus peremptorily given. A case of this kind has occurred in the present session—we allude to the bill of the Carlisle and Silloth Railway and Dock Company. This association was formed for the purpose of constructing a floating dock at Silloth Bay, in the Solway Frith, at the distance of 21 miles from the city of Carlisle. In the course of the ensuing year a railway will be completed to Drumburgh, which will be within 13 miles of Silloth Bay; and it was intended a branch should be carried from there to the dock, so that it would be in direct communication with Carlisle. The eastern ports of England carry on a great trade with the west coast and Ireland; while the harbours on that side are totally inadequate for the greater purposes of commerce. Carlisle is now one of the most important centres of railway communication between Scotland and all parts of England; and branches from it intersect all the northern counties. So great is the importance of a harbour and dock there, that, if carried out, it would lessen the distance from Newcastle to Ireland to under 200 miles; while the undertaking would have been of so much benefit to the community at large, it would have materially improved the value of property, and enhanced the interests of the district which would have been more materially concerned with it. It appears that for 135,000*l.* these objects could be carried out. The provisional committee were composed of men of the first standing in the city of Carlisle and the county adjacent; and there is no doubt that, could they have obtained a bill, the capital would have been easily raised in the locality. The chairman of the committee (Lord Jocelyn) himself observed that the plan was not only a local benefit, but would be likewise a national advantage. Members of Parliament, whose constituencies were likely to reap the advantages to be attained by the proposed improvements, expressed themselves strongly in its favour; and several influential merchants in Belfast, Drogheda, and other ports on the eastern coast of Ireland, cordially agreed with that opinion. It appeared, according to the evidence of one of the surveyors, that, in particular parts, there was not deep water enough for vessels to lay at all times, though this was controverted by other authorities. The Port Carlisle Railway offered the company every encouragement, and were willing to afford them all the assistance in their power. The port at Silloth Bay would have been the nearest one for the transhipment of coals, coke, and glass from Newcastle to all parts of Ireland. At present, the trade from that important city to the sister island is carried on by coasting vessels, who must make the tedious and dangerous voyage round the Channel. The city of Carlisle is daily rising in importance; within the last year several large manufactories for brick-making and pottery have been started; and if adequate harbour accommodation were provided, the commerce of the city would increase. Instead of being dependent on tidal ports, here could be constructed a haven in which ships could enter at all hours; and steam communication could be effectually carried on with Liverpool, Belfast, Drogheda, and several other towns. We are unable to assign any reason why the committee rejected the bill. It cannot, of course, be committed again this session; but we could counsel the promoters to persevere in their laudable efforts to carry out the important undertaking they propose. They have met with some opposition, and probably will have more to encounter. Let them not despair; eventually they must overcome their difficulties, despite cavilling or vexatious obstacles. So beneficial an enterprise must not, will not, prove abortive.

Great North of Scotland Railway.—The works on the portion of this company's line from Kittybrewster, about one mile from Aberdeen, to Huntly, 40 miles in length, are progressing towards completion; and it is expected that it will be ready for traffic next month. It is estimated that the cost will not exceed 8500*l.* per mile, and that a traffic of 850*l.* per mile per annum, or 17*l.* mile per week, is probable, and will yield a dividend on the estimated cost of 5 per cent. per annum.

Mineral Resources of Turkey.—A private letter from Constantinople says—"Mineral deposits of immense value are found in Rumelia and also in Thessaly, consisting, for the most part, of galenas, very rich in silver, and also in copper, iron, and alumstone. We found considerable quantities of gold, intermixed with a number of water-worn rubies, in the ferruginous sands of the valley of the Ardagh, which unites with the Maritza, about two miles north-west of Adrianople, and there is little doubt that the sources of this gold deposit is in the arm of the Balkan, called the Rhodope, to the north of Salonica. The coal formations in the neighbourhood of Adrianople are very extensive, and also near Haskoe, which is about midway between Adrianople and Philipilio. In the immediate neighbourhood of Adrianople the coals are of an intermediate quality, between lignite and true coal, but near Haskoe the coal is fully equal to good English. The analysis of the latter, which we made at the Ecole Militaire (placed at our disposal by the Turkish Government), showed it to contain over 9000 cubic feet of gas per ton, of a quality equal to good Newcastle, and 65 per cent. of coke. The mineral deposits in Thessaly are unbounded, particularly that part which forms the peninsula between the Gulf of Volo and the Grecian Archipelago. This peninsula is an elongation of the southern arm of Mount Olympus, and embraces Mount Ossa and Mount Pielion. From the examinations which I have been able to make, it appears that Mount Pielion and its slopes are a mass of mineral wealth. Pielion is composed of alternating strata of crystalline limestone and schist, intersected by countless beds and veins of galena, rich in silver, copper, arsenic, antimony, iron, and some gold."

Geological and Mining Surveys.—Mr. Ramsey, the Prof. of Geology and Director of the Geological Department of the Government School of Mines, is engaged in checking the recent survey of the new red sandstone formations in this district, with the view of ascertaining the relative connection of the various beds with the coal measures, and to determine their approximate thickness. This subject is of vast importance as a basis of future mining operations beyond the limits of our present coal field, and the discoveries which have been made and will shortly be published are startling, and of great value.—*Wolverhampton Chronicle.*

ON M. MARIE-DAVY'S NEW ELECTRO-MAGNETIC ENGINE.

BY M. BECQUEREL.

Attempts have been made for the last 20 years, to construct machines in which the magnetic property imparted to soft iron by the electric current should be employed as a motive power; but the electro-motive machines hitherto brought forward have been far from presenting any economical advantages over steam-engines.

Any electro-magnetic engine must be composed essentially of a series of electro-magnets of soft iron, of armatures also of soft iron, or arranged as electro-magnets, with various adjuncts, for the transmission of the electricity furnished by a battery or electro-magnetic machine, and of a commutator or breaker, for the purpose of producing a continuous circular or backward and forward motion.

In the machines hitherto constructed, these various parts do not combine all the conditions desirable for making use of all the power set in action; a cheap, constant, and powerful source of electricity does not yet exist; the soft iron, never being pure or perfectly malleable, retains for a longer or shorter period after each interruption a portion of the magnetisation which had been communicated to it by the current; the primitive current and the extra current produce contrary effects, causing a mutual injury; and the commutators often present alterations when the circuit is closed.

M. Jacobi, moreover, who has carefully studied the subject of the practical employment of electro-magnetic engines, has arrived at this result,—that the mechanical effect or amount of work, considering the expenses necessary to keep them in action, is far inferior to that of the other motive powers in use. But this does not set the question at rest, for, if we succeed in discovering sources of electricity more economical and powerful than those at present in use, and in avoiding a portion of the inconveniences already mentioned, electricity and magnetism may take their place with heat as motive forces.

These considerations show that all researches having for their object the removal of some of the difficulties encountered in the employment of electricity as a motive power, should be received favourably; and the memoir recently presented by M. Marie Davy to the Academy contains some new views worthy of attention, as will be seen from the following report.

M. Marie thought, and with reason, that in order to obtain the maximum of effect in electro-magnetic engines, the electro-magnets and the armatures must act up to the point of contact, seeing that the electro-magnetic force, as he found by calculation and experiment, decreases so rapidly with the distance, that in employing two electro-magnets, when these are brought together from a distance to the point of contact, they develope an amount of work in such a manner that five-sixths are produced in the last millimetre, and the half of the remainder in the last but one; when the second electro-magnet is replaced by an armature of soft iron, three-fourths of the quantity of work are produced in the last millimetre through which the armature passes, and more than half the remainder in the last but one. In most of the rotatory electro-magnetic machines hitherto constructed, the moveable armatures pass rapidly before the fixed electro-magnets, following a line perpendicular to the axis, without coming into contact; thus the entire amount of work that might be obtained is not made use of. We must, however, refer to the fact, that Mr. Froment, who has paid much attention to the electro-magnetic motor apparatus, has constructed a machine in which an interior wheel, furnished with armatures of soft iron, revolves upon the terminal faces of the fixed electro-magnets, so as to make use of the magnetic attraction even up to the point of contact of the magnetised surfaces; but this arrangement produces, during the action of the machine, a series of shocks or concussions, which are opposed to the construction of a powerful machine upon this model.

M. Marie makes the moveable electro-magnets or armatures revolve in such a manner as to approach the fixed electro-magnets in the direction of the axis up to the point of contact, without any shock. Upon this principle are constructed the two electro-motive machines described in his note, one of which has a continuous rotatory, the other an oscillatory motion. We shall only refer to the former apparatus, of which he has prepared a model, which has worked in our presence.

This machine consists of 63 electro-magnets, arranged at equal distances round a circle of wood, furnished internally with a circle of copper. All the electro-magnets have their axes directed towards the centre of the wheel, and their surface coincides with the concave surface of the copper circle.

In the interior of this large wheel there are two others, of which the radius is one-third of that of the former; these are also furnished with a circle of copper, and bear each 21 equidistant electro-magnets, of which the axes are directed towards the centre, and the polar surfaces coincide with the concave surface of the copper wheels; these little wheels can then revolve, without slipping, in the interior of the large wheel, and carry round by their movement the axle of the machine, which coresponds with the axis of the large wheel. The moveable electro-magnets come successively in contact with the fixed electro-magnets. The large and small wheels are furnished with teeth for the maintenance of the coincidence, when this is once established.

The machine is also provided with various pieces of apparatus for putting each of the electro-magnets successively in communication with the battery, and giving a different magnetisation to the two electro-magnets at the moment when they act upon each other.

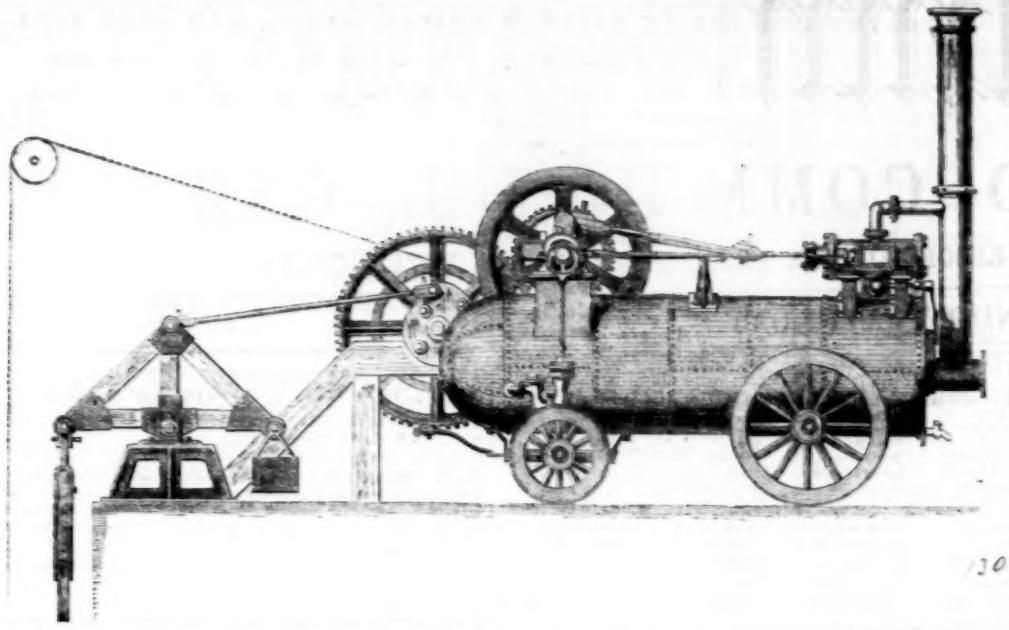
M. Marie has made a change which appears advantageous, by replacing the internal wheels by others, which, instead of bearing electro-magnets, are surrounded by a ring of soft iron, which forms the armature; the moveable portion is thus rendered lighter, and the teeth are rendered unnecessary. It is this modification of the machine that we have seen in action. The circular electro-magnets of Mr. Nickels will here find an interesting application; and, at our suggestion, M. Marie proposes to make some experiments with this addition, which will enable him to augment the power of the machine without increasing the expense.

The construction of the machine is somewhat affected by the inexperience of the maker, so that it required a battery of 24 Bunsen's elements to produce 1-23d horse-power. But, according to M. Marie's calculations, one of the same energy, or perhaps even one of less intensity, would be sufficient, with a machine of large size, to produce 300 times the power, seeing that the friction would not increase in the same proportion as the force of the machine; the means of electrical communication not being changed, and the power produced by the attraction of the magnets being capable of multiplication in a great degree, by making use of electro-magnets formed of large cylinders of soft iron. The model was constructed with a view to show the relations between the effect calculated from the magnetic force developed in the electro-magnet, and the actual force produced. The proportion was as 4 to 3, which is already a very close approximation, considering the numerous imperfections resulting from the bad construction of the machine.—*Comptes Rendus.*

Substitute for Gutta Percha, &c.—M. Sorel, C.E., of Paris, has patented some improved compositions to be employed as substitutes for caoutchouc, gutta percha, and certain fatty bodies. The principal bases of these compositions are the following substances:—Colophony or common resin, bitumen or natural pitch, or the pitch obtained from gas-works, fixed resin oils, gutta percha, hydrated lime, and water. The above substances are employed (by weight) in about the following proportions:—Colophony, 2; pitch or bitumen, 2; resin oil, 8; hydrated lime, 6; gutta percha, 12; water, 3; pipeclay or other like argillaceous earths, 10.

Holloway's Ointment and Pills again successful in curing a Bad Leg.—Mr. E. Williams, of Dylife Mines, Machynlleth, states that a friend of his in Flintshire, suffered for two years with a dreadful bad leg, which defied the efforts of several persons to cure, notwithstanding various remedies were tried. He endured excruciating pain for several months, and when paying him a visit he recommended him to use Holloway's ointment and pills, from the effects of which a change for the better was quickly produced, and ultimately his leg was soundly cured. He now enjoys excellent health. Mr. Williams will satisfy any party of the truth of this statement.—Sold by all dealers in medicine, and at Prof. Holloway's establishment, 244, Strand.

MEDWIN AND HALL'S PATENT PORTABLE STEAM-ENGINE ON WHEELS.



The woodcut represents a new arrangement of boiler and engine, successfully introduced for several years by MEDWIN and HALL. Its construction affords a wide field for the application of portable steam-engines, embracing capabilities rendering employment of steam more general than hitherto contemplated or offered by any previous competitor.

The portable engines commonly used are worked by locomotive boilers—liable to get out of order, and used almost exclusively for agricultural purposes—to which MEDWIN and HALL'S engines are also applicable, though not regarded as the primary part of their object, but to be employed in work of greater magnitude, required by contractors, colliery owners, miners, and especially for the Colonies, in sawing, pumping, grinding, crushing, hauling, winding, stamping, and every purpose to which steam power is available. Manufactured with or without wheels, from 4-horse power to 50-horse power. The whole of the motional parts are fixed on the boiler, including a pump to feed the same, a fly-wheel, which may be used as a band-wheel, or the power applied in any other way.

The boiler is different from any other, being what is termed "the Horse-Shoe"—very economical in fuel—the furnace arranged to burn wood or coal at pleasure: they have an efficient safety-valve, and MEDWIN and HALL'S patent steam and water gauges, thereby preventing the possibility of accident from shortness of water, or overpressure of steam. May be worked by the most inexperienced person.

92, Blackfriars-road, London.

The following observations appeared in the *Morning Advertiser*, *Morning Post*, *Daily News*, *Standard*, and *Sun* newspapers, and in the *Mining Journal*:—

PATENT PORTABLE STEAM-ENGINE.

We witnessed on Thursday a trial of a new Portable Steam-Engine, constructed by Messrs. MEDWIN and HALL, of the Blackfriars-road, which is undoubtedly a vast improvement, and must, if we mistake not, cause a complete revolution in mining operations. Any mine now requiring steam-power can obtain that important auxiliary in a few weeks. Our columns continually testify to the delays in surface operations, arising either from the difficulty in obtaining masons, or even, when the engine-house is completed, the time that is lost in the erection of efficient machinery. It is well known that the portable engines generally used are worked by locomotive boilers, which are liable to get out of order, and thus cause vexatious delay and expense. In Messrs. MEDWIN and HALL'S this complaint is not likely to occur. The whole of the motional parts are fixed on the boiler, including a pump to feed it, and a fly-wheel, which may be used as a band-wheel, or the power applied in any other way. The boiler is different from any other, being what is termed the "horse-shoe." The present engine has been constructed for the Old Trewether Consolidated Mining Company, and was started in the presence of several members of the committee; it is called a 20-horse power, although capable of being driven to 25. The speed was 60 strokes per minute, and performed the work in such an admirable manner, that not the slightest vibration is perceptible. It consumes about 6 lbs. of coal per hour per horse power, and the total weight is only 8 tons. The Old Trewether Company intend sending it to the mine by railroad, and confidently expect to have the water in fork three weeks after its arrival. At the time of the shaft filling with water there were 35 tons of antimony, which, as the company intend to smelt themselves, they estimate of the value of £35 per ton. The portable engine will enable them to realise the amount in a less number of weeks than under the old system they would in months. The company will also have the advantage of removing the power to any part of the mine, at a trifling expense. We understand the Great Duchy Silver-lead Mine hired one of these engines for three months, and, from the admirable way it has worked, have since purchased it. Messrs. Medwin and Hall have also supplied them to the Dowlais Iron Company and the Aberyschan Iron-works, for the purpose of winding and pumping. Mr. Medwin took out a patent on the 23d of August for still further improvements in generating steam in engines on the top of boilers. Mr. Medwin's improved water and steam gauge was attached to the engine we have noticed, and acted admirably.—*Mining Journal.*

The following is a list of engines sold during the present year:—

Hudson's Bay Company.	H. Bent, Esq., London.
Southampton Dock Company.	Messrs. Grissell's, R. C. Ironworks, Lond.
Aberschan Iron Company, Wales.	J. Nelson, Esq., Warwick.
Dowlais Ironworks, Wales.	J. Blackwell, Esq., Dudley.
Penllyne Court Mine, Wales.	Old Trewether Mine, Cornwall.
Fennaen Mine, Wales.	Great Duchy Silver-Lead, Cornwall.
North Towy Mine, Wales.	J. Croft, Esq., Brighton.
Poltimore Mining Company, Wales	Messrs. C. J. Mare and Co., Millwall.
Sir A. Webster, Bart., Dolgelly, Wales.	Imperial Austrian Government.
Jno. Knowles, Esq., Worcester.	Austrian Lloyds, Trieste.
Bristol Water-works.	East Indian Railway Co., Moorgate-st.
Hon. Board of Ordnance.	J. Paul, Esq., Worthing.
Messrs. Fox, Henderson, & Co., London.	Bristol Water-works Company.
J. Kelk, Esq., London.	
Inverness Bridge, Rochester Bridge, and the Chelsea New Bridge.	

FOREIGN MINES.

Quartz Rock Mariposa.	Alliance Gold Mining Company.
Carsons Creek Mining Company.	Ave Maria Gold Mining Company.
Anglo-Australian Gold Mining Company.	Anglo-Californian Gold Mining Company.
Dalecarlia (of Sweden) Silver-lead Mining Company.	Mount Alexander Gold Amalgamating Co.
	British Australian Gold Mining Company.

The following is a list of contractors, and others, who have rented these engines during the present year:—

Thos. Jackson Esq., Pimlico.	Thos. Earl and Co., Westminster.
J. Kelk, Esq., Pimlico.	Messrs. Baker and Sons, Lambeth.
G. Myers, Esq., Lambeth.	Messrs. Rigby, City.
— Spicer, Esq., Richmond.	Messrs. Piper and Sons, City.
— Carless, Esq., Richmond.	Messrs. Knight and Son, Bow.
J. Perry, Esq., Hackney.	Messrs. Bates and Co., Lock's-fields.
— Cooper, Esq., Leicester.	Crystal Palace Company, Forest Hill.
H. Johnson, Esq., Dudley.	R. Goodison, Esq., Lewisham.
W. Dethick, Esq., London.	J. Clark, Esq., Furnival's Inn.
— Smith, Esq., Woolwich.	B. Fowler, Esq., Whitefriars.
W. Piper, Esq., Lambeth.	— Richards, Esq., Blackfriars.
Messrs. Newall and Co., Newcastle.	— Spiller, Esq., Blackfriars.
Messrs. Hutchins and Co., Millwall.	Messrs. Kuper and Co., East Greenwich.
And many others.	

The following are certificates, received from the owners of these engines, now at work at mines, &c.:—

Old Trewether Consolidated Mining Company, Cushion-court, Old Broad-street. Sept. 8, 1853.

GENTLEMEN,—In accordance with your request, I have this day examined Messrs. MEDWIN and HALL'S Portable Patent Steam-Engines. I beg to say that I was highly pleased in the way and manner the 20-horse power engine, for the Old Trewether Lead, Silver, and Antimony Mines, worked this day 70 strokes per minute. The engine is calculated to do much more if required. The boiler, weighing about 4 tons, of the very best quality iron, and well put together; other parts will bear the strictest examination—the engine, in all, weighing about 8 tons. The whole is set on four wheels, like any other carriage, taken off or put on in a few minutes, and can be moved from one place to the other at the shortest notice. I think, as a miner of long experience, that these engines will answer every purpose for new mines and quarries, and in places where there is not a large quantity of water, and a 50 or 60 cylinder steam-engine is not required. In a short time we shall see long and expensive adits done away with, and MEDWIN and HALL'S engines set up to sink our mines to a depth of 30, 40, or 50 fms. There is no doubt on my mind but these engines are the best and cheapest ever invented for a quick trial; and those, like Mr. Cochran's crushing machines, will be in general use throughout England and elsewhere. Great credit is due to the inventors of those valuable machines. W. VERRAN.

Great Duchy Mine, Lanteglos near Camelford, Sept. 17, 1853.

GENTLEMEN,—In answer to your enquiry as to the working of the portable high-pressure steam-engine hired by the Great Duchy Mining Company, and afterwards purchased by them, I beg to state, from nearly nine months' experience, that it works very well; much better, indeed, than we at first expected. I have known many mines, when first started, that have presented most favourable indications, but have been abandoned just on the eve of good discoveries, from the inability of the adventurers to work them, for want of top water for wheels, or a sufficient capital to erect a Cornish steam-engine, and other parties coming after them have derived all the benefit. I allude, of course, only to those mines where the water is not very plentiful, and a large engine is not, therefore, required. In such cases your portable engines will be found of great service, and I can strongly recommend the adoption of them to mining parties. Wishing you every success,

I am, Gentlemen, your obedient servant, W. PENROSE.

Tregardock Mine, Feb. 2, 1854.

GENTLEMEN,—Agreeably with your request some time since, I beg to say, yesterday I inspected the portable steam-engine you sent from your firm to the Old Trewether Mine, near Port Isaac. I find it is an engine of 20-horse power, with two cylinders attached to the boiler, with an efficient safety-valve, and patent steam and water gauges; thereby preventing the possibility of accident, from shortness of water, or overpressure of steam. I find the company of the mine has put the engine in gear, or on the winch principle, which will answer well. The engine works in the house 4½ strokes to one in the shaft, which causes the engine to work more steadily, and answer better in the shaft. I found it capable of going full 50 strokes a minute in doors, and 12 in the shaft, without the least difficulty, and with a very moderate consumption of coals. This engine, I consider, will thoroughly prove the mine, and put it to a very considerable depth below what it is at present, and should the present Old Trewether Company prove as lucky as former companies, a fortune is sure to ensue. I must say great credit is due to the projectors of this engine, which will answer, and is well adapted for many of our Cornish mines. With these engines we can pump, wind, crush, or stamp, &c. One remark I wish to make is, great credit is due to Mr. George Terril, the fitter up. Wishing you every success in the sale of these engines,

I am, Gentlemen, yours truly, W. PENROSE.

To Messrs. Medwin and Hall.

Old Trewether Consols, near Wadebridge, Cornwall, April 3, 1854.

GENTLEMEN,—I have much pleasure in bearing testimony to the efficiency of your 20-horse patent portable steam-engine, which is now at work in the above mine. The engine, since her erection, has been working exceedingly well. She is now, with a 6 in. box, drawing water with the greatest facility, 50 fms. deep. This duty appears scarcely anything for the engine to do. The coals she at present consumes is, on an average, from 6 to 7 cwts. in 24 hours. I could strongly recommend your patent portable engines for the working of shallow mines, particularly where despatch and economy is studied. I am, Gentlemen, your most obedient servant,

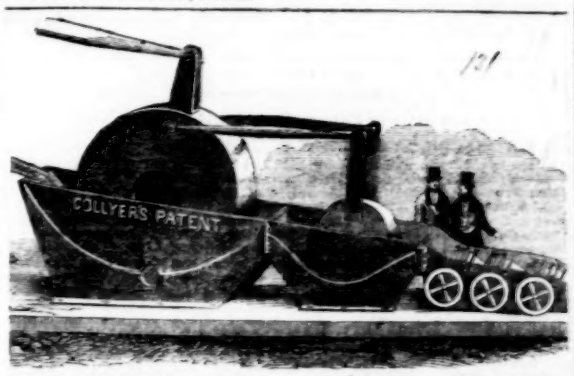
Messrs. Medwin and Hall. RICHARD VERRAN.

North Towy Mine, Carmarthen, April 8, 1854.

GENTLEMEN,—In reply to your favour of the 31st March, I am much pleased with the portable engine supplied to this mine by your company. It performs its duty exceedingly well, and I consider them well adapted for the development of lodes at a shallow depth. We are now working with a 6-in. lift, and with our present amount of water, I consider that the engine will drain the lode to the 40 fm. level.

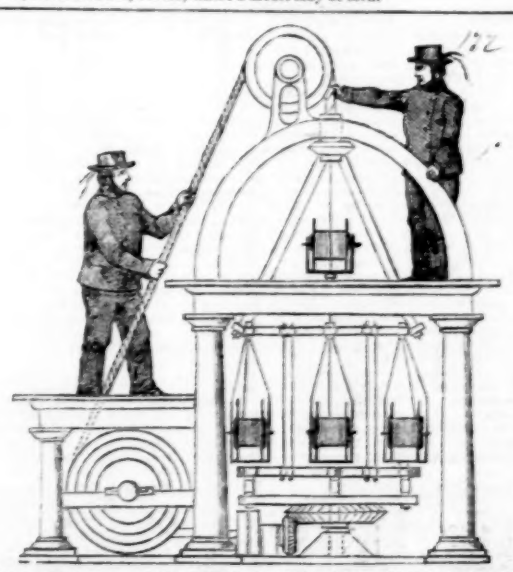
I am, yours respectfully, W. H. REYNOLDS.

Messrs. Medwin and Hall, London.



DR. COLLYER'S GOLD ORE MACHINE is COMPLETED, and NOW IN OPERATION at the establishment of Messrs. RANSOMES and SIMS, IPSWICH. The machine has accomplished all that was expected, and has elicited the admiration of all competent judges in gold mining. Those who desire to witness it, can do so by visiting the Orwell Works, Ipswich.

No. 4, Norfolk-street, Strand, where a model may be seen.



IMPROVED PATENT WIRE ROPE.—Mr. ANDREW SMITH, the ORIGINAL INVENTOR of WIRE ROPE, LIGHTNING CONDUCTORS, and SUBMARINE TELEGRAPHS, solicits the attention of the public to his IMPROVED PATENT MANUFACTURE, as the best and cheapest, having obtained his sixth patent since 1835.

Office, 69, Princes-street, Leicester-square, London.

TO OWNERS OF MINES AND COLLIERIES, MINE CAPTAINS, AGENTS, FARMERS, &c.—JOHN H. ROBINSON (late J. Oliver and Co.), GREASE MANUFACTURER, OIL REFINER, &c., NEWCASTLE-ON-TYNE.—Office, 62, Close.

Oils for Machinery of every description, Pine Oil, Patent Grease, &c. 133

TO MINING COMPANIES, AND ALL CONNECTED WITH STEAM-POWER.—PLANS, SPECIFICATIONS, with ESTIMATES of ALL KINDS of CORNISH MACHINERY, comprised of the most approved modern descriptions and economical principle, may be SEEN at the offices of the Cornish Engineers and General Contractors, Cannon-street Chambers, Cannon-st., City, London. 134

OLD ESTABLISHED MANUFACTORY OF MINERS' UNDERGROUND HAT CAPS.—E. COCK, REDRUTH, CORNWALL, is at all times prepared to execute UNLIMITED ORDERS for MINERS' UNDERGROUND HAT CAPS, which he is sending to all parts of the globe, adapted to every climate. 135

REUBEN PLANT'S PATENT MINERS' SAFETY-LAMP

MANUFACTURED BY

SALT AND LLOYD,

BIRMINGHAM.

The great obstacle with which the working miner has had to contend in the use of the ordinary safety-lamp is its small amount of illuminative power, by which his work is much curtailed in quantity. The great desideratum of an abundance of illuminative power, combined with safety, is now secured by this patent, in which, by the employment of glass internal cylinders, and metallic gauze of silvery whiteness, a light far superior to a naked candle is obtained; and there is no inducement to the men to remove the tops of the lamps.

"A lamp which, with all the simplicity of the Davy, and with great reduction in weight, has very great illuminative power, and possesses the elements of perfect safety."—*Mining Journal.*

IMPROVED LIFTING JACKS,

MANUFACTURED BY

W. AND J. GALLOWAY,

PATENT RIVET WORKS,

MANCHESTER.

The attention of parties who employ

Lifting Jacks,

Is respectfully requested to the superiority of those annexed, over those hitherto in use.

IMPROVED RATCHET JACK.

HALEY'S PATENT LIFTING JACK.

NICHOLLS, WILLIAMS, AND CO., ENGINEERS AND IRON FOUNDERS, BEDFORD FOUNDRY, TAVISTOCK; and ROSHLAN VALE FOUNDRY AND HAMMER MILLS, LISKEARD; beg to announce to t Gold Mining Companies, that they are manufacturing HORIZONTAL and PORTABLE STEAM-ENGINES of all sizes, fit for PUMPING, CRUSHING, and OTHER PURPOSES. There are several advantages over the perpendicular rotary engine: 1. The bob is dispensed with, and heavy sweep rod.—2. The cost of erection is much less, both in engines and buildings; sheds put up with wood may be applied instead stone walls, especially in foreign climes, where wood is plentiful, and can be renewed at much less cost. Also, MANUFACTURERS of CHILIAN CRUSHING MILLS (on the newest principle), and CORNISH CRUSHERS, similar to those used in the mines of Devon and Cornwall. DRESSING and MINING TOOLS of every description kept ON SALE.—Companies supplied with working engineers and mechanics, for erecting machinery in any part of the world.

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